



TEMESCAL

metallurgical corp

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WESTERN UNION FGC

October 19, 1966

T. Nelson
Box 1546
Poughkeepsie, New York

Gentlemen:

Thank you for your recent inquiry on Temescal Electron Beam Vacuum Systems.

Temescal is the world's largest producer of electron beam equipment and systems and has pioneered the use of electron beam for production applications. Over 10,000,000 Watts of electron beam power has been installed to date for a variety of applications. Applications have included batch, semi-continuous and fully continuous vacuum coating systems and electron beam melting and casting furnaces. In addition, Temescal is a major producer of vacuum induction furnaces and other special systems.

Temescal Electron Beam Vacuum Systems have been delivered in the following general classifications:

Batch Type Vacuum Coaters

Bell Jars to 10ft. diameter chambers equipped for single or multiple coating work for electronics, optical or general R & D applications.

Fast Cycle Coaters

Systems specifically designed for production in electronic and optical applications. Typical systems coat a complete load of substrates in a total cycle as short as 2 minutes, with all functions under automatic control.

Semi-Continuous Coaters

Systems designed for production, where parts are fed in and out of the vacuum chamber thru entrance and exit locks. The largest system of this type coats 10' x 12' substrates in a chamber 240' long, utilizing 3600 KW of electron beam power.



Continuous Coaters

Systems involving "air to air" vacuum seals for the continuous passage of the substrate through the vacuum coating chamber.

Electron Beam Melting and Casting Furnaces

Furnaces from lab scale (50 to 100 KW) to the largest Cold Hearth E.B. Furnace (1200 KW).

Crystal Growing

Vacuum Furnaces using electron beam heating.

Temescal Electron Beam Power Supplies are offered in 3 KW to 600 KW sizes to cover any coating or melting requirements.

As an example of one type of system being offered by Temescal, a typical specification on "fast cycle" production coater is enclosed for your review.

We are most anxious to discuss your vacuum system requirements with you and invite your inquiry to:

TEMESCAL METALLURGICAL CORPORATION
Merwin Building
Wilton, Connecticut
Telephone: 415-841-5720

Thank you for your interest in Temescal.

Very truly yours,


Arthur E. Anderson
Marketing Manager

Enclosure

AEA/jl

TEMESCAL SPECIFICATIONFAST CYCLE ELECTRON BEAM COATER1.0 GENERAL

- 1.1 The Temescal Fast Cycle Coater is designed to incorporate present state of the art techniques in electron beam and vacuum technology, in applications where production quotas or environmental control dictates a more efficient tool than the conventional bell jar system.

The system is an intermediate step between the outdated bell jar unit and the elaborate continuous vacuum line. This system was designed to retain the simplicity and familiarity of the laboratory unit and still yield profitable quantities and the strict control required in any production process.

The techniques and components utilized in this machine have all been thoroughly field tested as individual units and Temescal has many hours of operational experience with this equipment in systems of far greater complexity.

The completely automated operation of this system may be tailored to your most exacting requirements simply by the setting of variable program controls. Once these parameters are programmed into the system, reproducibility of the vacuum process is guaranteed. A few of the parameters which may be pre set and maintained are; roughing time (ie: pressure), degree of vacuum attained prior to actual processing, exposure time of substrate to vacuum prior to coating, substrate pre-heat time and temperature, source pre-heat, evaporation rate, film thickness of one or more layers of material, cooling time, venting time and loading chamber ambient.

Many of these parameters may be varied individually in order to observe their effect on the total process with no dependence on the faithfulness of the operator.

TEMESCAL SPECIFICATION
FAST CYCLE ELECTRON BEAM COATER

System cleanliness and a reproducible vacuum environment is assured by isolation of the evaporation chamber from the loading area. The evaporation chamber remains under high vacuum at all times and need be opened only for routine cleaning and maintenance. Metal flakes and other debris associated with the evaporation process are undisturbed since the turbulence of air encountered in the roughing cycle is restricted to the isolated loading section.

- 1.2 The equipment includes a main evaporation chamber, two vacuum pumping systems, vacuum control panel, electron beam power supply, gun, rate controller and all necessary wiring and plumbing.
- 1.3 The system, as supplied, will be complete and ready to operate after necessary water and power connections are made. The entire system shall be operated and performance verified at Temescal in Berkeley, California.

2.0 DESIGN BASIS

- 2.1 Vacuum Chamber: Stainless steel, water - cooled where necessary.
- 2.2 Operating pressure: $< 5 \times 10^{-6}$ torr range
- 2.3 Ultimate vacuum: 10^{-8} torr range
- 2.4 Vacuum pumping speed: > 500 liters per second
- 2.5 Overall dimensions:
 - Height - 51"
 - Depth - 35"
 - Width - 40"
- 2.6 Cycle Time: < 2 minutes for $10,000\text{\AA}$ of aluminum on an unheated substrate.

TEMESCAL SPECIFICATION
FAST CYCLE ELECTRON BEAM COATER

3.0 EQUIPMENT

3.1 Evaporation Chamber

- 3.1.1 One 8" ID vacuum chamber 24" high, stainless steel construction precision finished interior. Chamber traced as needed, with water - cooling lines. Viton gasketing throughout.
- 3.1.2 Chamber will be furnished with a flange lid which will provide full access for cleaning.
- 3.1.3 One each Sight Port, 3" diameter, will be provided.
- 3.1.4 Gun assembly and rate monitor will be flange mounted.
- 3.1.5 Appropriate feeder mechanism will be supplied based on material to be evaporated.

3.2 Loading Chamber

- 3.2.1 One combination valve and substrate carrier, stainless steel construction and viton gasketing.

3.3 Pumping System (Evaporation Chamber)

- 3.3.1 One Temescal 6" (nominal) 2530 stainless steel high vacuum valve, pneumatically operated.
- 3.3.2 One D&W liquid nitrogen trap. Trap features a constant temperature cold wall and positive anti-migration shield. L N consumption is less than 0.5 liters per hour and a large reservoir to provide 12 to 15 hours of holding time.
- 3.3.3 One CVC - PMC - 1441 6" Diffusion pump or equal.

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- 3.3.4 One Welch 1402c Mechanical pump, 5 cfm.
- 3.3.5 One Temescal Model 1130 1-1/2" pneumatically operated roughing valve.
- 3.3.6 One Temescal Model 1130 1-1/2" pneumatically operated foreline valve.
- 3.3.7 One Temescal Model 1110 3/4" manually operated leak detector valve.
- 3.3.8 One Welch 1397c Mechanical Pump, 15 cfm (for loading lock vacuum).
- 3.3.9 One Temescal Model 1130 1-1/2" pneumatically operated roughing valve (for loading lock).
- 3.3.10 One Temescal Model 1130 3/4" pneumatically operated vent valve (for loading lock).
- 3.3.11 All necessary valves and manifolding to make a complete system.

3.4 Control Panel

- 3.4.1 One control panel for vacuum system controls including a graphic display panel and provisions for manual control of all pumping functions.
- 3.4.2 All necessary motor starters, switches, water-flow valves, water-flow switches, oilers and filters for air lines. All air and water lines are terminated at a single connecting point to make a clean, neat piping arrangement.
- 3.4.3 One Temescal Model IG 1300 Triple Thermocouple, Single Ionization Gauge Control. This control is designed for use with Bavard-Alpert hot-wire ionization gauge tubes. It is a high quality and extremely stable instrument.
 - Thermocouple Gauge Range: 1000 to 1 Micron.
 - Ionization Gauge Range: 10^{-4} to 10^{-9} torr
 - in six ranges.

TEMESCAL SPECIFICATION
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3.4.4 One Temescal Rate and Thickness Monitor (see attached specification).

3.5 Accessories

3.5.1 One Temescal feeder assembly (specific feeder mechanism depends on material or materials to be evaporated).

3.5.2 Removable shielding to prevent evaporation chamber from becoming heavily coated with evaporant.

3.6 Electron Beam Equipment

3.6.1 One Temescal Model CV-10 constant voltage power supply (see attached specifications) modified for single gun use.

3.6.2 One Temescal transverse focusing electron beam gun. Gun will be for 10KW operation and flange mounted to facilitate maintenance.

3.7 System Cabinet

3.7.1 The entire vacuum system is enclosed in a modern metal cabinet. All necessary controls and the loading area are located for maximum convenience of operation.

3.8 Optional Equipment

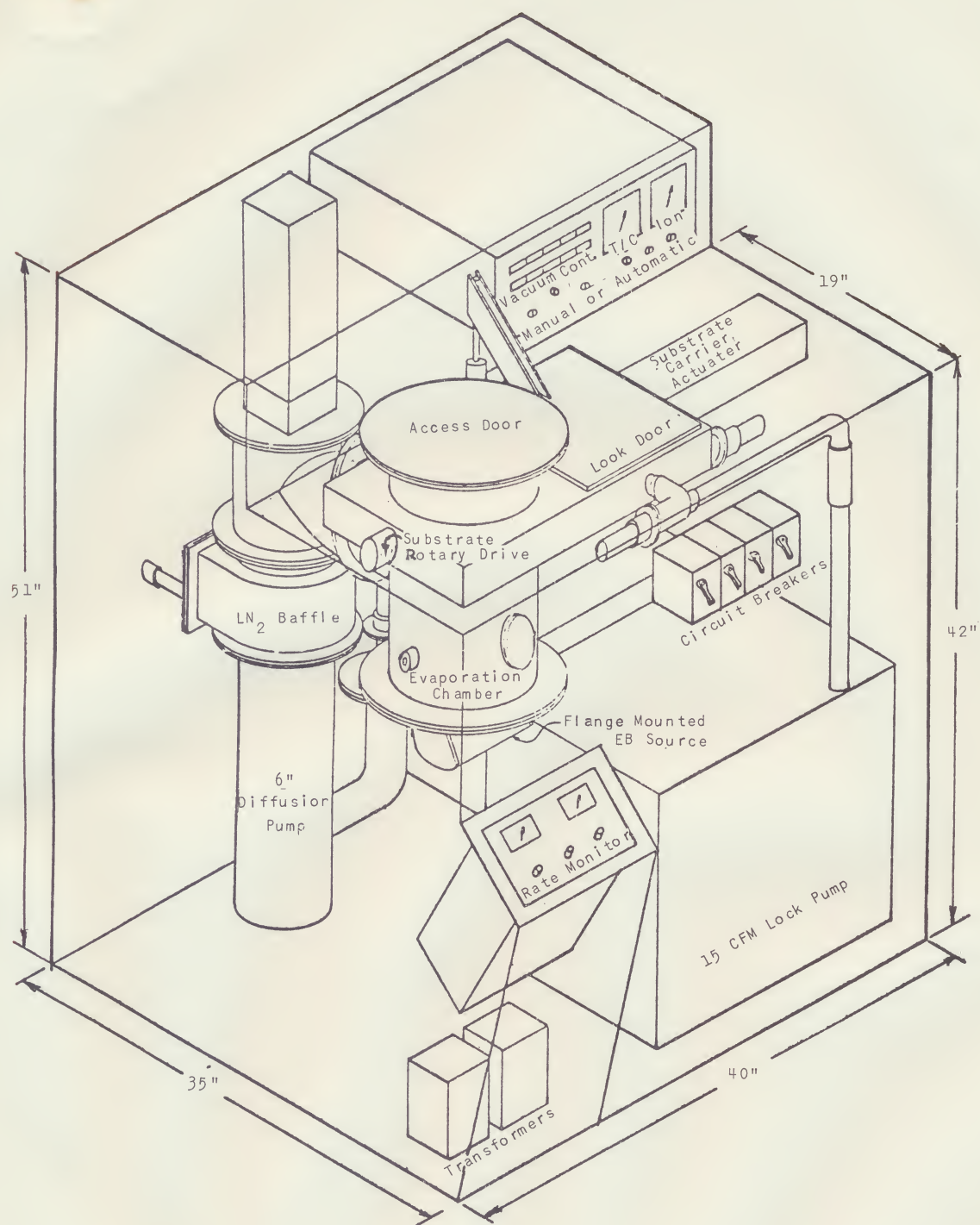
3.8.1 Evaporation sources for multi-layer coatings (up to four different materials).

3.8.2 Appropriate feeders for the above sources.

3.8.3 Rotary substrate holder.

3.8.4 Substrate heater and temperature controller.

3.8.5 Automated controls on feeders.



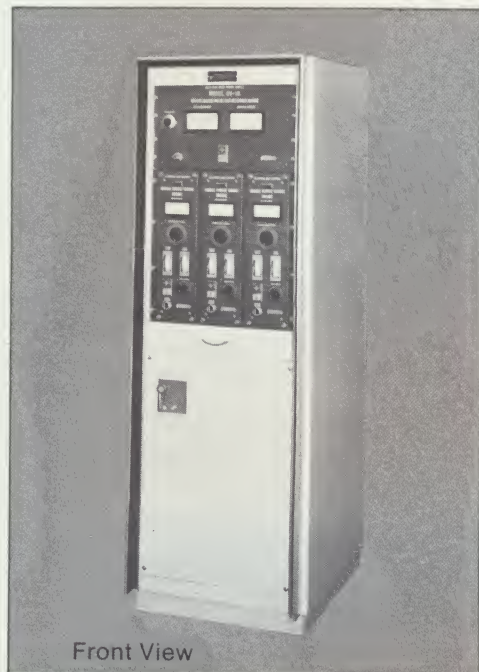
TEMESCAL FAST CYCLE COATER

PROPRIETARY

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TEMESCAL ELECTRON BEAM POWER SUPPLIES

CONSTANT VOLTAGE MODEL CV-10



Front View



Control
Panel
View



Gun Module View

FEATURES

- 10 Kilowatt power capability
- Operates up to 3 guns independently in the same or separate vacuum chambers.
- Triode control for instantaneous arc-down recovery.
- Emission stability $\pm 2\%$ per gun
- Voltage adjustable between 4 and 10 kv
- Input connection for remote control of each gun
- Individual pre-heat for each gun
- Independent interlock for each gun
- All solid state rectification
- Programmed sweep control (option)
- Programmed rate control (option)

DESCRIPTION

The CV-10 is designed for laboratory or industrial use and can power up to three electron guns in the same or separate vacuum chambers, with each gun operating at an independently adjusted power level.

The CV-10 output can be adjusted from 4 to 10 kilovolts, and is regulated within 2% for precise control. Each gun's beam current can be adjusted independently and remains stable within $\pm 2\%$ regardless of the changes in the current drawn by the other two guns.

Stability is accomplished by directly sensing emission current of each gun, as well as the output voltage. In either case reference signals are compared in a closed loop system to provide precise regulation, repeatability of settings and compensation for line and load changes.

The main panel contains the emission voltage control and meter, total emission current meter, key lock, and high voltage on-off switch. The individual electron gun control modules contain emission current control, beam position control, gun filament control, and their associated meters. Interlocks are provided for the **power-on, water, air, rear door, operator's key and spare circuits**. In each gun control module, the **vacuum tank, vacuum gauge, gun water and focus coil protection circuits** are also interlocked.

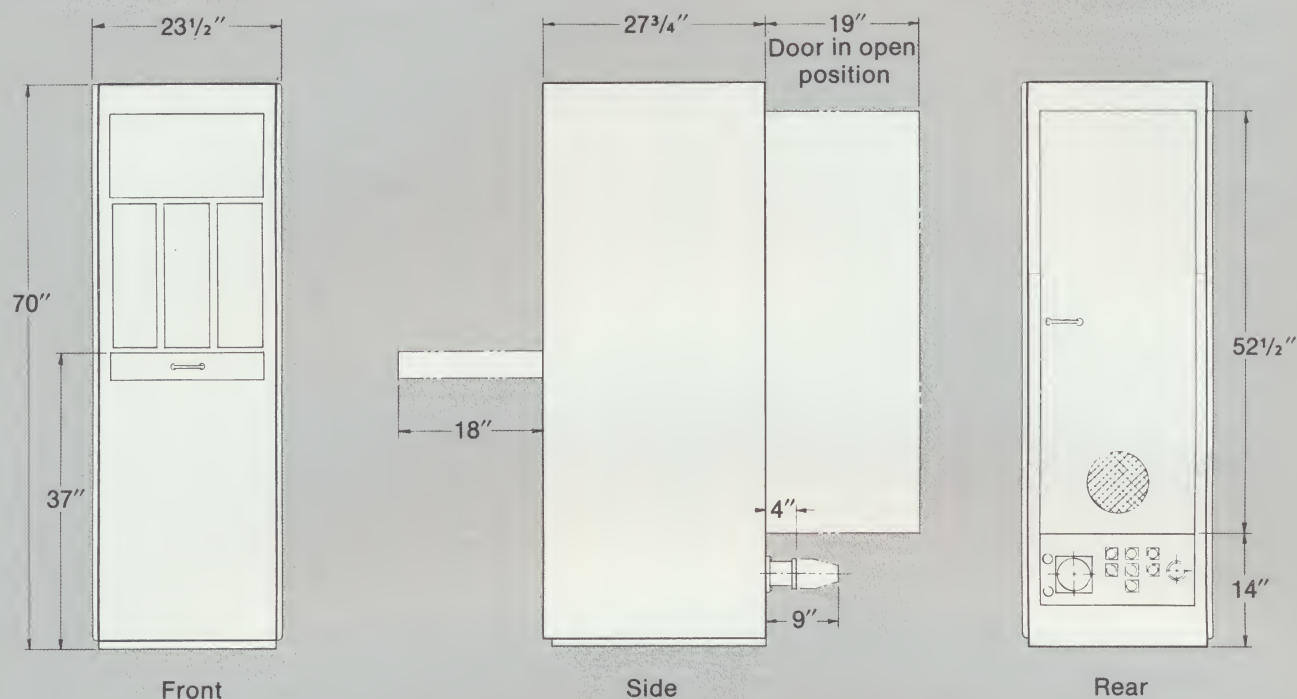
In multiple systems operation, opening an individual interlock chain removes the high voltage and automatically grounds **that** gun.

A pull-out writing table is conveniently located beneath the gun control modules. All connections to the power supply are made with heavy duty, full shielded threaded connectors. For portability the supply is mounted on casters.

TEMESCAL, THE WORLD'S LARGEST PRODUCER OF ELECTRON BEAM EQUIPMENT AND SYSTEMS

TEMESCAL ELECTRON BEAM POWER SUPPLIES

**CONSTANT
VOLTAGE
MODEL CV-10**



STANDARD MODELS

OPTIONAL FEATURES

MODEL	NO. OF GUN MODULES	NO. OF VAC. SYSTEMS*	Programmed Sweep Programmed Rate Control X-Y Deflection Non-Standard Cable Lengths Non-Standard Input Voltage
CV-10-210	2	1	
CV-10-220	2	2	
CV-10-310	3	1	
CV-10-330	3	3	

*Designates the number of vacuum systems in which guns can operate independently and simultaneously.

ORDERING INFORMATION

All orders should specify model number and options as well as primary electrical power.

WEIGHT

1015 pounds.

STANDARD HARDWARE

A ten foot power cable, interlock cable(s), high voltage leads and filament transformers are provided.

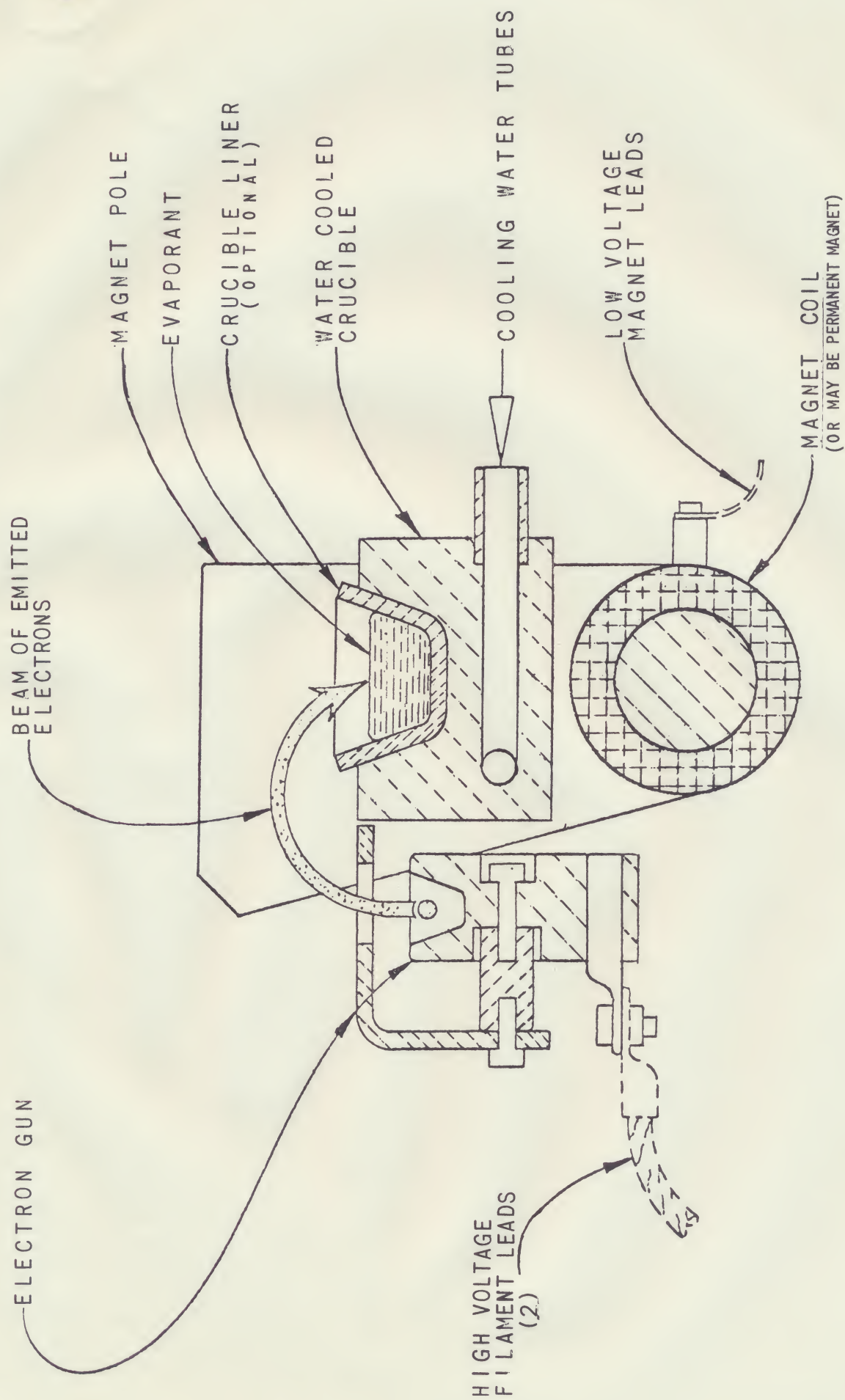
POWER AND COOLING REQUIREMENTS

15 KVA, 208 volt, 3 ϕ Y Center Tap or 230 volt delta is standard, water 4.8 GPM.

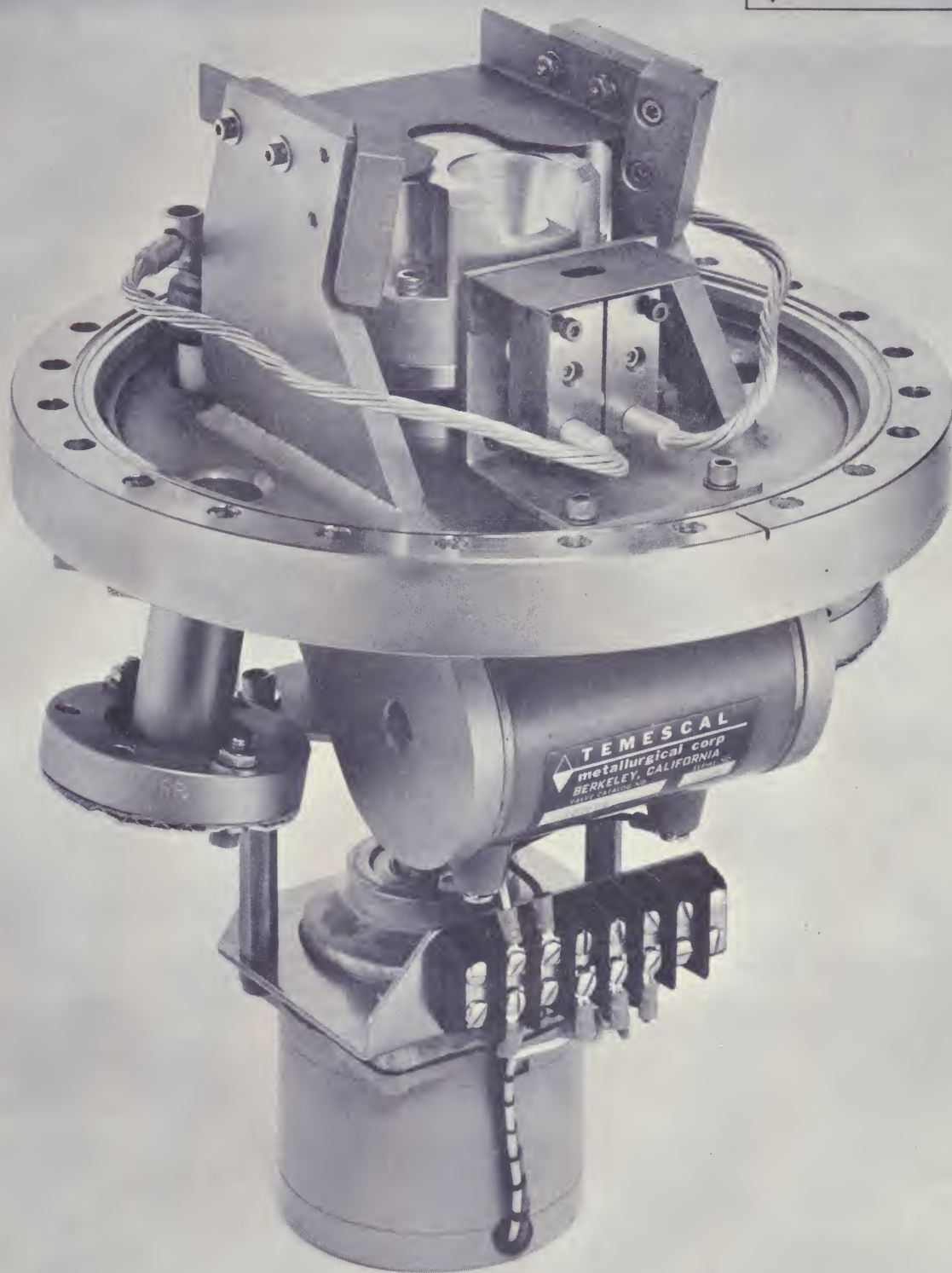


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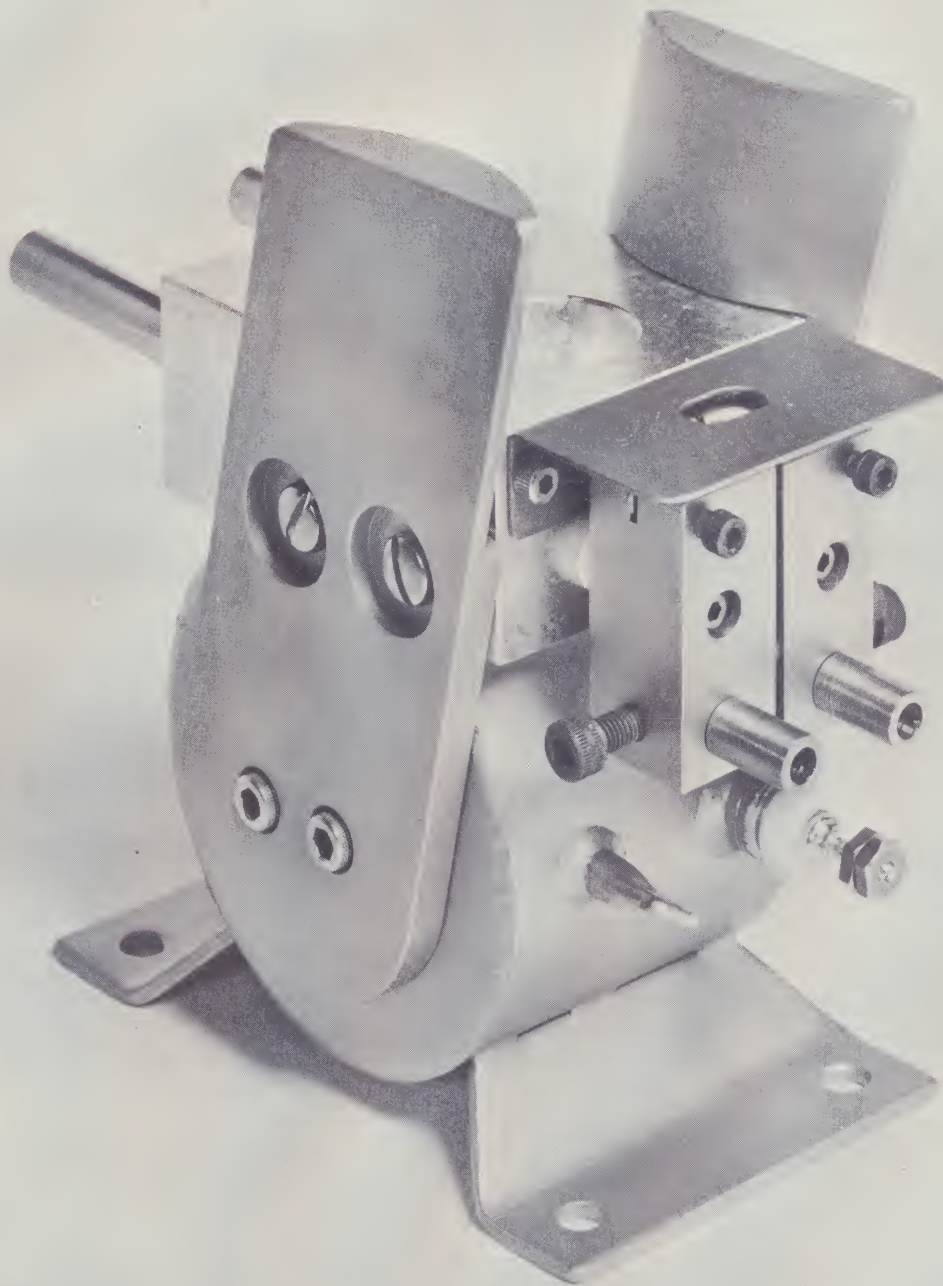


ELECTRON BEAM VAPOR SOURCE
NOMENCLATURE



model 10 TFXE 100

TEMESCAL ELECTRON BEAM GUNS



model 10 FIH 400

TEMESCAL ELECTRON BEAM GUNS

PRELIMINARY

TEMESCAL RATE MONITOR

GENERAL INFORMATION

The Temescal Rate Monitor is a complete instrument for monitoring and controlling the evaporation rate of all types of E.B. vacuum depositions. Universal application is made possible by quantitative analysis of the vapor issuing from the source rather than measurement of second effect parameters such as reflectivity, resistance, or condensation on temperature sensitive crystals.

Specifically, the Rate Monitor consists of two units plus interconnecting cables. When material is evaporated by bombardment with electrons, the vapor is excited by the impinging electrons. By measuring the intensity of excitation, a quantitative measure of rate is obtained. The sensing head is positioned so that an optical path exists from the head through the vapor stream. The signal from the sensing head is taken out of the vacuum system through a flexible coaxial lead and into the indicating unit.

In the indicating module, the sensing head signal is compared with a variable reference (desired rate setting). If the signal is higher or lower than the desired rate setting, a control voltage is generated which calls for more or less power to the source. This power control signal is generated continuously and responds immediately to rate changes.

Normally, when the first call for power is established by the control system, before the source begins to evaporate, the power control circuit would call for the upper limit of power which is available.

A limiting feature is built into the circuit so that such instantaneous overloading is not possible. In addition to this, a maximum power adjustment is included to limit the total amount of power available.

When the evaporation source consists of poorly consolidated or gaseous materials, it is essential that an extremely slow power rise be used in the early stages of warm-up (generally classified as a pre-heat cycle). Normally the pre-heat power is slowly brought to a level considerably below the power range for evaporation and then held there for some extended soak period. The injection of a pre-heat cycle into the control signal generator circuitry accomplishes all these pre-heat functions. The rise time set and soak time controls consist of simple adjustment knobs which program these parameters across a wide spectrum of values. As is obvious, this is an entirely programmed phase of the cycle, however it does automatically revert to a closed loop power control system when this pre-heat cycle is finished.

TENTATIVE SPECIFICATIONS

- Rate Control Range - Equivalent to $< 1\text{A}^\circ/\text{sec}$ to $> 1000\text{A}^\circ/\text{sec}$ at 10" source to substrate distance.
- No practical limit to the deposition cycle since monitoring system is non-accumulative.
- Sensing head is water-cooled for long-term temperature stability.
- Control Signal - 0-9VDC
- Power - Nominal 115V, 60 Cy.
- Price - Complete system with pre-heat cycle, water cooled sensing head and all required interconnecting circuitry -- \$1,200.00
- Delivery - 6 Weeks
F.O.B. Berkeley, California